

REMARKS

Claims 1-3 stand rejected under 35 U.S.C. 103 over Johnson (US 5,520,708) in view of Kovacs (WO 03/040081). Applicants respectfully submit that this ground of rejection has been overcome.

First, on September 7, 2010 Applicants provided a Declaration under 37 CFR 1.132 from inventor Dr. Rudolph Bönsch, stating that the formation of an emulsion of crude methyl ester and a strong acid as required by the present claim 1, step (c), is not possible in view of the teachings of Johnson. Dr. Bönsch clearly indicated in his Declaration that the acid materials and process steps of Johnson would be insufficient to form an emulsion as presently required. However, the Examiner now argues that the contents of this Declaration are insufficient to overcome this rejection. It is urged that the Examiner appears to be impermissibly substituting his own opinion for that of the expert, Dr. Rudolph Bönsch. Applicants request reconsideration of the Declaration provided on September 7, 2010, and urge that it is clearly sufficient to overcome the above 35 U.S.C. 103 rejection.

Regarding the rejection at issue, the present invention relates to a method for improving the long term stability of biodiesels. Step (a) provides the forming of a reaction mixture comprising a crude methyl ester, by transesterification of a vegetable or animal fat or oil with methanol. Indeed such transesterification with methanol is known in general the art, and is mentioned in column 3 of Johnson. Step (b) of the present invention relates to a phase separation step, wherein a layer containing the crude methyl ester of step (a) is formed and separated from the rest of the reaction mixture. Such phase separation is also known in general in the art, and is disclosed via the addition of hexane and a water wash in Example 1 of Johnson. However, an important feature of the present invention, which is *not* taught or suggested by Johnson, is the present step (c) which requires an intensive inline mixing of the crude methyl ester layer obtained in step (b) at temperatures between 25 and 60°C with a mixture of a strong acid and a complex former, to form an *emulsion*.

Nowhere does Johnson provide such an intensive mixing step with a strong acid and a complex former after their phase separation, as presently required. Further, nowhere does Johnson teach or suggest the formation of an emulsion *at all*. It is submitted that the differences between the above claimed invention and each of Johnson and Kovacs renders the present invention patentably distinct from this cited art.

The Examiner agrees that Johnson fails to disclose – either explicitly or implicitly – that the methyl ester obtained after their phase separation is intensively mixed with a strong acid. However, he goes on to assert that Johnson does mention the use of a strong acid elsewhere in their disclosure. Applicants respectfully point out that Johnson fails to teach the use of a *mixture of a strong acid and a complex former* as now required by the present claims, and furthermore, only teaches the optional use of a strong acid as an acid catalyst in the transesterification reaction, as described in column 3 at lines 25-35. In fact, the reference states that such an acid catalyst is *only* used where large amounts of free fatty acids are present in the oil. Example 1 of Johnson clearly teaches that the oil and the alcohol are vigorously stirred together with sodium alcholate. This is done to improve the reaction speed, because the oil and the alcohol do not mix together well (see Kovacs WO/03/040081 which states that it is known in the art that methanol and vegetable oil have only limited miscibility in each other, and catalysts are used in order to accelerate the reaction). The main part of the acid, which according to Johnson is only present in amount of 0.1 to 0.5% based on the weight of the oil, is discarded with the separated lower aqueous phase. Applicants urge that it is neither mentioned in the text of Johnson, nor is it obvious in view of their disclosure, to use a strong acid *after* the transesterification reaction and *after* the phase separation of their process, much less in a mixture with a complex former as presently required. Applicants urge that the Examiner is attempting to impermissibly reconstruct the art in light of Applicant's disclosure with no suggestion or motivation to do so, and that the requirements of the present claims are in no way taught by Johnson.

The Examiner has agreed that Johnson fails to teach that the methyl ester resulting from step (b) is intensively mixed to form an *emulsion*. However, he cites Kovacs in an effort

to fill the voids of Johnson, asserting that Kovacs teaches the use of high shear mixing in a homogenizer to form an emulsion. Applicants disagree, since first of all, Kovacs WO/03/040081 *incorrectly* states at page 3, lines 17-20, that U.S. 5,520,708 to Johnson teaches the use of a *homogenizer*. Applicants urge that no such homogenizer is taught in Johnson *at all*, and no mention of an emulsion is made anywhere in their disclosure. It is asserted that just because the reactants of their transesterification reaction are stirred vigorously *does not* indicate that an emulsion is formed. The Examiner attempts to assert, at pages 4 of the Office Action, that Kovacs' mention of the forming of an emulsion provides a motivation to do so in the scope of Johnson. However, it is again urged that the cited art would not have inspired one of ordinary skill and common sense in the art to form such an emulsion based on the teachings of Johnson. Not only do the examples of Johnson fail to form an emulsion, but nowhere in the disclosure of Johnson is the formation of an emulsion discussed or even contemplated. Thus, whether or not Kovacs teaches the presence of an emulsion or discloses that emulsions may be formed in general, there is no rational basis for modifying Johnson to include the formation of an emulsion without any motivation to do so. Furthermore, as stated in our arguments of November 7, 2008, it is traditionally known in the art that a crude ester phase is normally washed after the transesterification step, wherein phases may be mixed but an emulsion is typically *avoided*. The traditional reason for this is due to the fear that the emulsion becomes too stable and will not break into the two original phases. The present invention departs from the traditional method of avoiding the formation of an emulsion. That is, in the present invention, an emulsion is *required* and is *intentionally formed* by the use of intensive inline mixing apparatus. Surprisingly, the present method does not suffer from the traditional emulsion problems, i.e., that the emulsion will not break. Instead, after the breaking of the emulsion, there remains a stable interphase between washed ester phase and the heavy (wash) phase. It is therefore urged that the present invention would not have been obvious one of ordinary skill in the art by reading the quoted state of art. Again, whether or not Kovacs mentions the formation of an emulsion in general, the cited art does not discuss how one of ordinary skill would or could modify Johnson's materials and process steps to formulate an emulsion of any kind. Applicants further urge that there is no teaching or suggestion in the art which would lead one of ordinary skill to

formulate the inventive emulsions which do not suffer the disadvantages of emulsions traditionally known in the art.

Another important issue is that Johnson monitors their reaction by TLC and then *after* the completion of the esterification, adds a hexane/water mix to induce phase separation. Thereafter, the ester phase is washed with water. There is *no mention of a further* vigorous stirring of their mixture *after* the addition of the hexane/water mix or during the washing. The Examiner asserts on page 3 of the Office Action that based on Kovacs, it would be obvious for one skilled in the art to *repeat* the “vigorous stirring” step of Johnson with their ester-rich phase after the separation step. Applicants strongly disagree, since it is clear that Johnson’s vigorous stirring occurs in their transesterification reaction process *prior* to phase separation only. Again, it is urged that *no repetition* of the vigorous stirring or the esterification step of Johnson is taught by the reference. The Examiner asserts that a motivation to do so could be found in Kovacs. Applicants strongly disagree. While Kovacs relates to the transesterification of vegetable oils, they *do not* relate to a process for reducing the crystallization temperature of such fuel blends as taught by Johnson. Kovacs separates their oil into polar and apolar phases, followed by further refining of their apolar phase. Kovacs states at p.4 (WO/03/040081) that their *apolar* phase may be reacted again to obtain a desired *viscosity*. However, there is no teaching in Kovacs that a *polar* phase would need to be repeated. Furthermore, Kovacs teaches that such a repetition of their apolar phase is necessitated by the use of a homogenizer in forming an emulsion, which is not taught or used in Johnson.

It is further submitted that an aqueous strong acid must be used, in combination with a complex former, to form an emulsion according to the present step (c) while Johnson’s esterification reaction would necessitate the use of an anhydrous acid catalyst if present at all. The Examiner goes on to state that a twice-reacted reaction mixture “can” be again extracted with hexane and washed with water to induce a second phase separation. Applicants urge that the Examiner is using an impermissible “obvious to try” standard of patentability. As stated above, the cited art further does not teach or suggest the use of a complex former together with a strong acid as now required according to the presently

amended claims. This key difference further distinguishes the presently claimed invention from both Johnson and Kovacs.

Applicants further urge that there is a major difference in the makeup of the emulsions formed by the present invention, and the vigorously stirred mixture formed by Johnson. The present application forms an emulsion of acid in the separated ester-rich phase. In this phase there are only traces of the alcohol and by-products left, and it is emulgated with the strong acid. In contrast to this, Johnson has a completely different composition, no matter which time the Examiner assumes the mixture to be of equal quality. That is, if examining Johnson's reaction mixture before the addition of hexane/water, the mixture still contains all by-products and excess alcohol. If examined after the water washing point, the upper phase only has traces of acid left, since the acid was separated out with the lower aqueous phase. Thus, not only are the method steps of Johnson different from the present invention, but the methods result in the formation of completely different mixtures. It is thus urged that the reactions taking place with acid, and the distribution behaviors are completely different as well.

Finally, step (d) of the present claims requires the separation of an ester layer from the emulsion of step (c), and then subjecting the ester layer to a thorough water wash and a subsequent drying. Again, since an emulsion is not formed by Johnson, the present step (d) which relates to separating an ester layer from the *emulsion* cannot be deemed obvious in view of the cited art. Further, the Examiner agrees that Johnson does not teach a drying step. However, whether or not such a drying step is considered obvious on its own, it is submitted that the sequence of steps required by the present claims is not taught or suggested by Johnson and/or Kovacs, and would not have been obvious to one of ordinary skill upon a reading of the cited art.

Regarding the Examiner's comments on claim 3, the Applicants wish to respectfully point out again that a separatory funnel is neither a wash column nor does it work with the counter current principle. A separatory funnel is *by definition* a single extraction

stage which works batch-wise. Two immiscible liquids are introduced into the funnel, intensively mixed, and then allowed to separate again. There is no current at all.

For the above reasons, Applicants urge that it would not have been obvious to one of ordinary skill in the art to formulate the presently invention upon a reading of Johnson and/or Kovacs. It is therefore respectfully requested that the 35 U.S.C. 103 rejection be withdrawn.

The undersigned respectfully requests re-examination of this application and believes it is now in condition for allowance. Such action is requested. If the Examiner believes there is any matter which prevents allowance of the present application, it is requested that the undersigned be contacted to arrange for an interview which may expedite prosecution.

Respectfully submitted,



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